GOULD
*Electronics*

Manual Part No.
MU56-1302-00

# RMS PROGRAMMABLE SIGNAL CONDITIONER MODEL NO. 56-1302-00 USER'S MANUAL

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# SAFETY SUMMARY

The general safety information is for both user and service personnel. Specific **WARNINGS** and **CAUTIONS** will be found throughout the manual where they apply.

## TERMS IN THIS MANUAL

**CAUTION** statements identify conditions or practices that could result in damage to the equipment or other property. They will appear in boldfaced capital letters.

**WARNING** statements identify conditions or practices that could result in personal injury or loss of life. They will appear in boldfaced capital letters.

## SYMBOLS IN THIS MANUAL

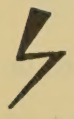
This symbol indicates where cautionary information is to be found.

## TERMS AS MARKED ON EQUIPMENT

**CAUTION** indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property, including the equipment itself.

**DANGER** indicates a personal injury hazard immediately accessible as one reads the marking.

## SYMBOLS AS MARKED ON EQUIPMENT



DANGER - High Voltage.

Protective ground (earth) terminal.

ATTENTION - Refer to manual.

## POWER SOURCE

This instrument is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential.

## GROUNDING THE INSTRUMENT

This instrument is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

## DANGER ARISING FROM LOSS OF GROUND

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

## USE THE PROPER POWER CORD

Use only the power cord and connector specified for your instrument. Use only a power cord that is in good condition. For detailed information on power cords and connections see Section 2, Installation, in the User's Manual.

## USE THE PROPER FUSE

To avoid fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified in the parts list for your instrument.

## DO NOT OPERATE WITHOUT COVERS AND PANELS INSTALLED

To avoid personal injury and equipment damage, the user should disconnect power before removing covers, panels or any grounding straps. Reinstall covers, panels, and any grounding straps *before* reconnecting power.

## *WARNINGS* FOR AUTHORIZED SERVICE PERSONNEL

Do not perform internal service or adjustment of this instrument unless another person capable of rendering first aid and resuscitation is present.

Dangerous voltages exist at several points in this instrument. To avoid personal injury, do not touch exposed connections or components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

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# GENERAL INFORMATION

## SCOPE OF MANUAL

This manual describes the Gould Signal Conditioner, Model 56-1302-00. See Figure 1-1. Its contents include the Signal Conditioner description, specifications, instructions for installation, operation, and maintenance which includes an accessory list.

## DESCRIPTION

The Gould Programmable 56-1302-00 DC Signal Conditioner uses state-of-the-art technology to provide new levels of functionality and performance in signal conditioners. Computer control, simplicity of operation, versatility, accuracy and proven reliability of Gould signal conditioners combine to make the 5600 the new industry standard.

The Signal Conditioner can be either computer controlled or operated manually via the front panel controls. Used with a 3000 Series Recorder, it provides full remote programmability and interchannel annotation of Signal Conditioner settings. Its DC-to-250 kHz frequency response makes it an ideal front end for data acquisition systems.

Input-to output isolation permits off-ground measurements up to 750 volts RMS, or 1500 with the optional high voltage connector. The Input-to-Output Isolation Module is installed in the Signal Conditioner when shipped. For non-isolated high frequency (250 kHz) operation, the isolation module must be replaced with a jumper board (CL-810287). See Section 2, Installation, in this manual for removal and installation instructions.

Calibrated zero suppression to 1000 volts, AC or DC coupling and a 15-millisecond rise time are all standard features on the 56-1302-00. This wide-band RMS Signal Conditioner permits precise amplitude measurements of dynamic signals with crest factors as high as 10:1. It calculates the true RMS value of any input signal from 10 mV to 750 VRMS by continually squaring the input signal, averaging the result, and then extracting the square root. The resultant DC voltage level is the true RMS value of the incoming waveform.

In addition to measuring AC signals, this True RMS Signal Conditioner also directly measures the RMS value of signals containing both AC and DC components. The AD/GND/DC button turns the 56-1302-00 into a fully programmable, isolated DC amplifier.

Other outstanding features of the 56-1302-00 include: microprocessor control of gain and operating modes; integral LED indicators and 4-1/2 digit display; and a low pass filter that can be selected.

## THEORY OF OPERATION

For illustration of the system, refer to the System Block Diagram, Figure 1-2.

### Input Attenuator

The Input Attenuator allows the Signal Conditioner to handle signals with amplitudes up to 750 volts (with isolation and in the differential mode). There are four steps: divide by 1, 10, 100 and 1000. If no ratio is

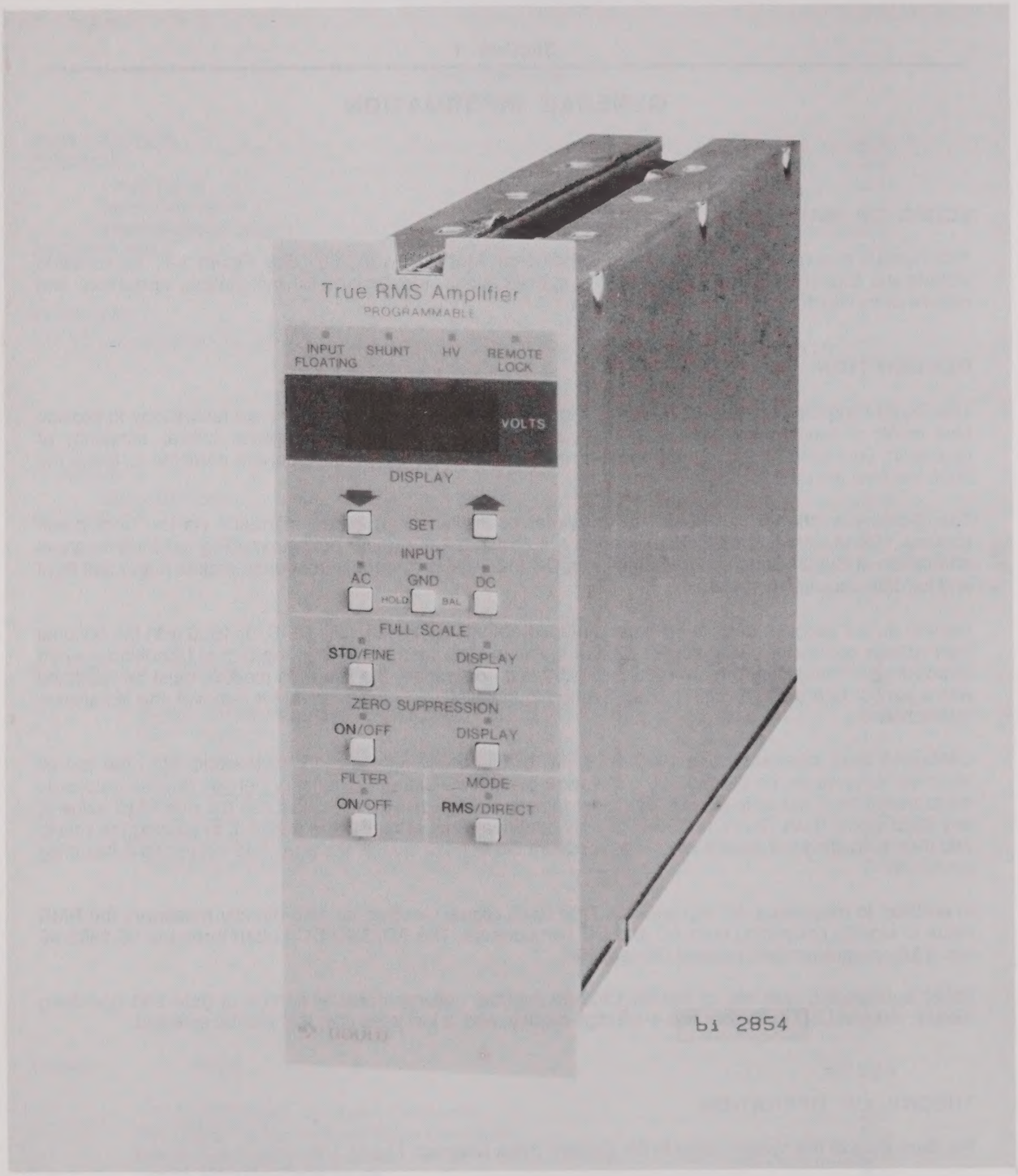


**FIGURE 1-1**
**PROGRAMMABLE RMS SIGNAL CONDITIONER**
**MODEL NO. 56-1302-00**

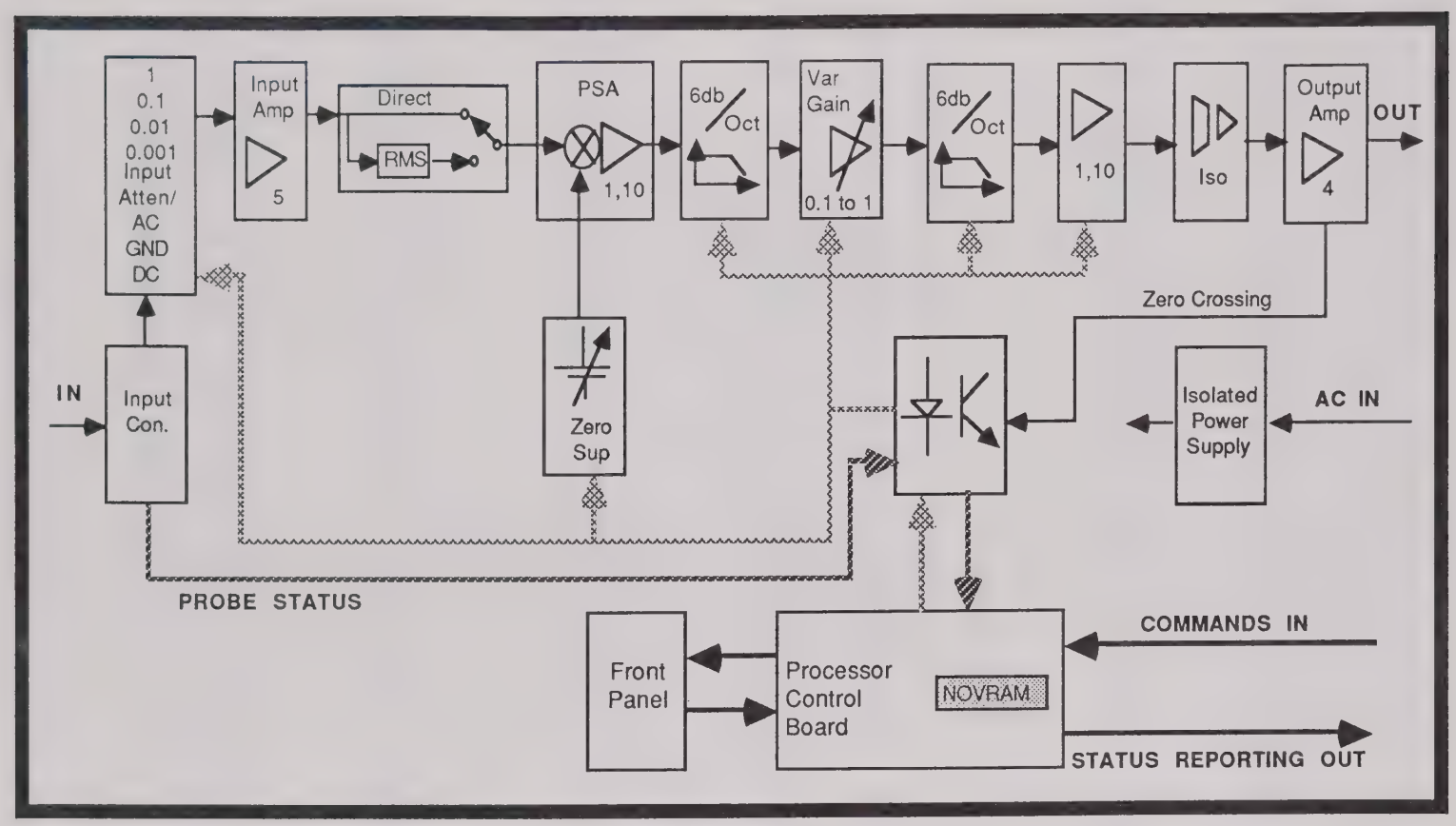


FIGURE 1-2
BLOCK DIAGRAM
56-1302-00 SIGNAL CONDITIONER

selected, the signal is disconnected from the Signal Conditioner and output is connected to output signal common. This way the GND function is performed and the Signal Conditioner is fully protected when power is off.

### Input Amp

The input amp has a gain of 5 and a resistor network to protect the signal conditioner's input when the signal exceeds the specified limits. See Appendix A for Specifications.

### RMS Converter

The output of the RMS module will be either the RMS value of the input signal (RMS mode) or the instantaneous signal (DIRECT) depending on the mode selected. The RMS module also contains a window comparator which acknowledges the Status Control Board when the signal is too large for proper operation.

### Programmable Amplifier

Three functions are performed by this section:

- Summing signal from the input amplifier with a programmable DC signal from zero suppression.
- Signal filtering, user programmable having a fixed filter that allows the user to select his own one or two pole low pass filter using the appropriate values. See Section 2, Installation.
- Provides calibrated gain from 0.1 to 100. More than a decade gain can be set with the 12 bit DAC resolution. Decade changes for gain are performed with two programmable amps. There are logic commands to set the gain in steps of 1, 10, 100 and to turn the filter on and off.

### Isolation Amplifier

This section together with the isolated power supply provides input-to-output isolation for the Signal Conditioner. The isolation module is a pre-adjusted module with a gain equal to 1. The Status Control board is informed of the isolated presence and the front panel displays "Input Floating"; the LED is turned ON. When the jumper board is installed the LED is turned Off.

### Output Amplifier and Zero Crossing Detector

The Signal Conditioner's overall gain is adjusted in this section. This circuitry also causes the output to change state each time the signal crosses zero. There is a small hysteresis designed into this circuitry to prevent triggering on noise.

### Zero Suppression

The Zero Suppression circuit produces a calibrated DC voltage used to change the Signal Conditioner's offset. The same circuit is used to adjust the Signal Conditioner's offset. When suppression is OFF, the DC signal is divided by 64 and used to balance the Signal Conditioner's offset in all ranges below 1 VFS. This information is stored in a non-volatile memory and used every time a range is selected. When suppression is ON, the value for offset is scaled and added to the value desired for suppression.

### Isolated Power Supply

Secondary voltage from this power supply is rectified and filtered and further regulated later in the circuitry to provide ±15 VDC to the Signal Conditioner and for user optional usage.

### Communication and Control Circuitry

All functions performed by the 56-1302-00 are under a microprocessor control. Controller and amplifier are fully isolated by opto-couplers. The Signal Conditioner receives information through a serial type communication and latches this information in command registers. The controller receives from the Signal Conditioner information concerning probe presence, isolation presence, signal zero crossing, and signal conditioner type. Signals from the Control Board are first shaped and then distributed to various locations on the Main Board.

## Section 2

# INSTALLATION

### GENERAL

This section describes the inspections and checks that should be made upon receiving the Gould DC Signal Conditioner. Covered in this section are the installation procedures, signal input connections, and the outline dimensions. Also contained in this section are the procedures for installing the jumper board in place of the isolator board or vice versa.

### INITIAL INSPECTION

Prior to attempting any electrical connections or operation, visually examine the unit for broken or loose knobs, dented or nicked panels and broken or chipped connectors. Make sure you read the Concealed Damage Card, Form No. 222640, which is enclosed in the shipping carton.

### INPUT-TO-OUTPUT ISOLATION MODULE

The input of the Signal Conditioner is isolated from chassis ground when shipped. A removable Input-to-output Isolation Module is installed. (Refer to Installation of Isolation Module.) To add bandwidth, a jumper board can be installed in place of the Isolation Module. This will attach common to chassis ground.

### INPUT CONNECTIONS

The 56-1302-00 is AC or DC coupled and has differential input. It is able to suppress input voltages of up to ±1000 volts. The input is isolated from chassis ground. The Signal Conditioner can be used with any signal input up to ±750 volts rms. The source may be floating, balanced to ground or single ended-grounded. For details on signal input connections and sources refer to Appendix B.

#### Input Connection Hardware

Input connections to the Signal Conditioner are made at the rear of the unit. See Figure 2-1 for the location of the Input Connector (J101). For signal input connections, use the special connector provided with the Signal Conditioner. To maintain the high level of integrity, a two wire shielded cable must be used (See Accessory List for Gould part number).

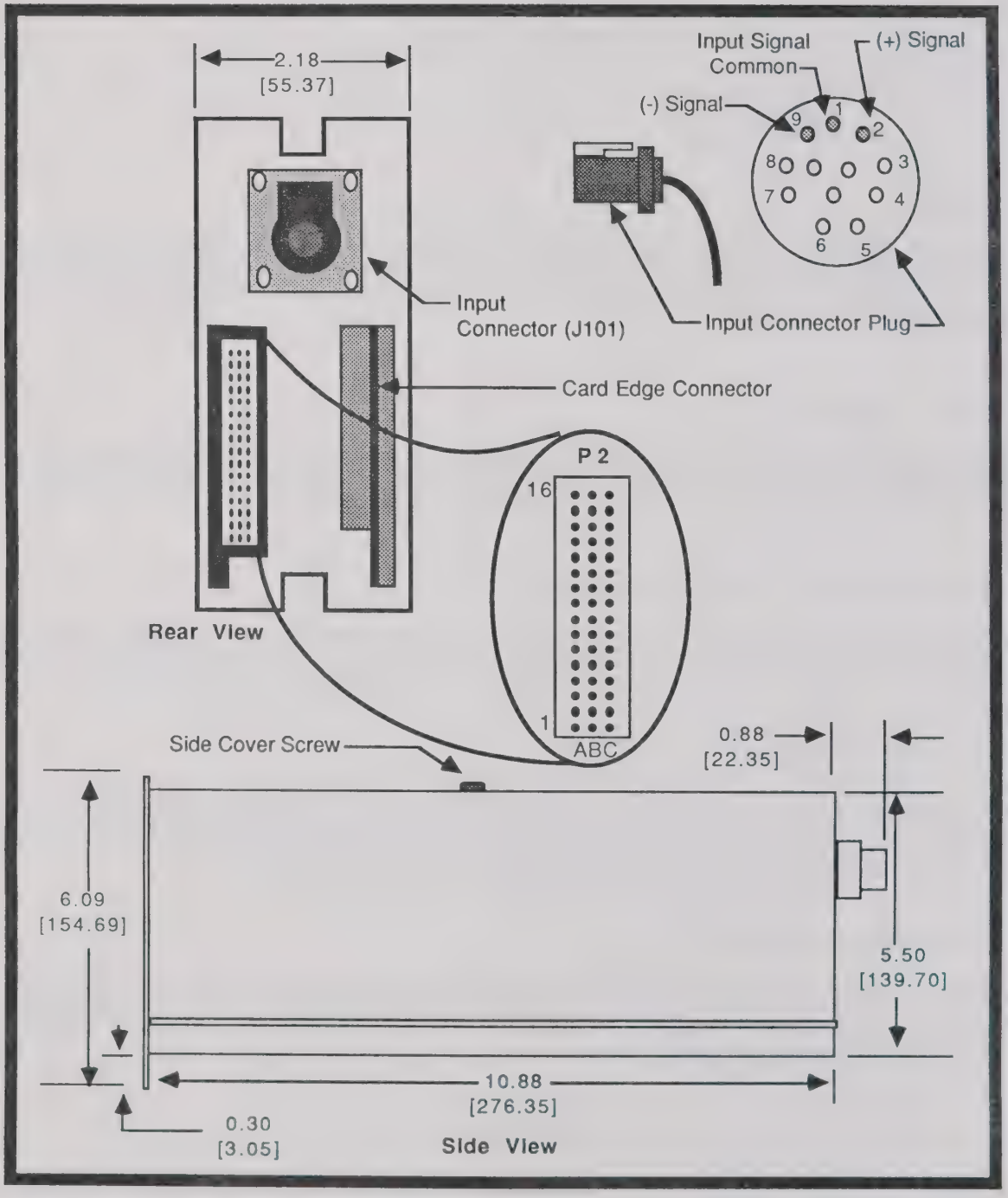


FIGURE 2-1
56-1302-00 SIGNAL CONDITIONER
(Rear and Side Views)

Table 2-1 lists the pin designations for the Input Connector, Part Number CL-211126-12.

**TABLE 2-1**
**PIN DESIGNATIONS FOR INPUT CONNECTOR (J101)**

| Pin | Name/Function | Pin | Name/Function |
|---|---|---|---|
| | | | |
| 1 | Input Signal Common | 7 | Chassis Ground |
| 2 | (+) Signal | 8 | No Electrical Connection |
| 3 | Probe 1 | 9 | (-) Signal |
| 4 | Probe Ø | 10 | (+) 15 volts |
| 5 | Relay | 11 | Power Common |
| 6 | No Electrical Connection | 12 | (-) 15 volts |

## OUTPUT - CARD EDGE CONNECTOR

Power and output for the Signal Conditioner are provided by the eight pin Card Edge Connector at the rear of the Signal Conditioner. (See Figure 2-1.) The Signal Conditioner requires ±15 volts at a maximum current of 100 mA and 13 volts RMS at 650 mA maximum. The +5 volts at 500 mA is required for the Status Control board. The Signal Conditioner provides a 5 volt full scale signal at its output. If the Signal Conditioner is used with a 3000 series Oscillograph Recorder, the Conditioner output is available at the BNC connector at the rear of the 5900 Signal Conditioner Frame Assembly. Table 2-2 lists the pin designations for the Card Edge Connector.

**TABLE 2-2**
**PIN DESIGNATION FOR CARD EDGE CONNECTOR**

| Pin | Name/Function |
|---|---|
| | |
| 1 | Power Common |
| 2 | Signal Output |
| 3 | (-)15 VDC |
| 4 | (+)15 VDC |
| 5 | Signal Common |
| 6 | No Electrical Connection |
| 7 | 13 VAC |
| 8 | 13 VAC (connected to chassis) |
| | |

## INSTALLING SIGNAL CONDITIONER INTO 5900 FRAME ASSEMBLY

The 56-1302-00 may be used with any of Gould's 3000 line of Oscillograph Recorders. The versatility in system configurations is made possible by the 5900 Signal Conditioner Frame Assembly. See Figure 2-2.

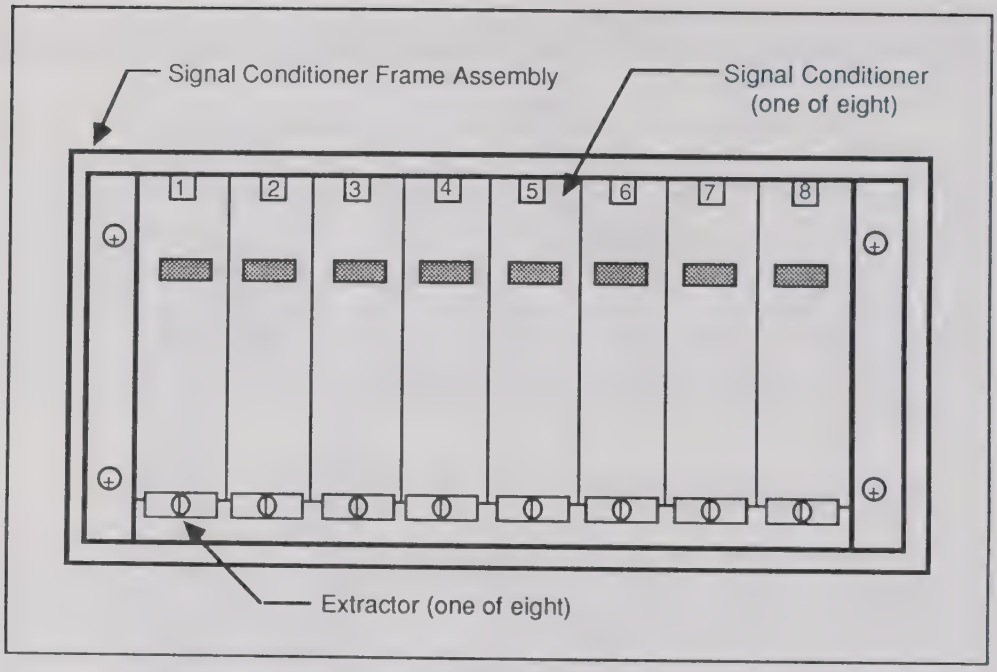


**FIGURE 2-2**
**SIGNAL CONDITIONER FRAME ASSEMBLY**
**(Front View)**

The Frame Assembly is a separate six or eight channel unit. It is built into the recorder case in two and four channel recorders. The assembly allows the Signal Conditioner to be operated as a stand-alone Signal Conditioner interfacing with any of the user's equipment. See Figure 2-1 for the outline dimensions of the Signal Conditioner.

### Insertion of Signal Conditioner into Frame Assembly

To install the Signal Conditioner into its appropriate slot in the Frame Assembly perform the following:

1. Turn power OFF to the Frame Assembly with the power switch (located in the rear of assembly). Make certain the extractor located at the bottom of the cage slot is unlocked, i.e. the screw is loose and the extractor pulled completely forward. See Figure 2-2.

2. Slide the Signal Conditioner into the Frame Assembly until it makes contact with the backplane connector. It will then require a little force to seat the the Signal Conditioner into the backplane connector. The front panel of the Signal Conditioner should be flush with the front panel of the Frame Assembly.

3. Lock the extractor by pushing it in and tightening the screw.

4. Install the input connector plug at the back of the Signal Conditioner by pushing it on and making certain the release mechanism has engaged. See Figure 2-1 for the connector plug.

### Removal of the Signal Conditioner from Frame Assembly

1. Turn power OFF to the Signal Conditioner Frame Assembly with the power switch (located at the rear of the unit).

2. Disconnect the input connector plug by pushing on the release mechanism. See Figure 2-1.

3. Loosen the extractor (see Figure 2-2) located at the bottom of the slot by turning the screw counterclockwise. Pull on the extractor until the Signal Conditioner releases.

4. Carefully slide the entire Signal Conditioner from the Frame Assembly.

## INSTALLATION OF ISOLATION MODULE AND PLUG-IN CAPACITORS

### Isolation Module

In the 56-1302-00, the Input-to-Output Isolation Module (Gould P/N CL-210287) is installed in the Signal Conditioner when it is shipped. It can be replaced with a jumper board (P/N CL-810287) to increase the Signal Conditioner's bandwidth to 250 kHz when operating in the DIRECT mode. (In the RMS mode, the upper limit of the bandwidth is 250 kHz with the jumper board or the Isolation Module.) See Installation below to install the jumper board.

### Filter (Frequency Change)

The filter frequency, 3 db down, can be altered by changing two plug-in capacitors. See Installation instructions below to peform the change.

### Installation

To install or remove the Isolation Module (or Jumper Board) and to change the plug-in capacitors for the filter, perform the following procedure:

1. Remove the right-hand side cover (as view from the front of the unit) by unscrewing one posi-drive #4-40 screw located at the top of the cover flange. See Figure 2-1. Remove the side cover by pulling up and out from the Signal Conditioner case.

2. Unscrew five posi-drive #4-40 screws from the Status Control board (on the right-hand side).

3. Lift the board gently from the case and allow it to swing back toward the front panel. The board cannot be completely removed from the Signal Conditioner case because a short ribbon cable (26-pin) connects the Status Control board to the Main Amplifier board. Carefully unplug the connector (J2) at the Main Amplifier board permitting the Status Control board to be swung out of the enclosure and the Main Amplifier board to be accessed.

**WARNING**

**INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT MAY RESULT IF SIGNAL COMMON AND AMPLIFIER CHASSIS ARE NOT AT THE SAME POTENTIAL WHEN THE ISOLATOR MODULE IS REMOVED.**

4. **Jumper Board Installation** - If the Jumper board (P/N CL-410287) is being installed, perform the following procedure:

   a) Locate the position of the Input-to-Output Isolation Module on the Main Amplifier board. See Figure 2-3.

   b) Remove two nuts, screws, washers, and plastic standoffs from the Isolation Module.

   c) Remove the Isolation Module from the board by gently lifting it from its socket. Retain the module for future use.

   d) Align the 13 pins of the Jumper board with the socket pin holes on the board and insert. Install the two plastic standoffs, washers, screws and nuts in the Jumper board.

5. **Installation of Plug-in Capacitors** - To alter the 3 db corner frequency, change the CX and CY plug-in capacitors with the following procedure:

   a) Locate the capacitors on the board. See Figure 2-3 for the location of the capacitors.

   b) Use the formula CX(uF)=CY=15/F(Hz) x .68uf (original capacitance). F is the new corner frequency at 3 db down. See the example below.

      EXAMPLE

      For a frequency of 60Hz:
      CX = CY =15/F(Hz) =15/60 x .68 uf
      CX = CY = 1/4 x .68uf = .17uf

   c) Remove four screws and retaining clamps that secure capacitors to the board.

   d) Remove old capacitors and install new capacitors which will produce desired frequency level.

   e) Reinstall clamps and screws.

6. Connect the cable from the Status Control board to the Main Amplifier board. Make certain the connector is properly seated. Position the Status Control board in the Signal Conditioner. Secure the board with the five posi-drive #4-40 screws.

7. Replace the right-hand side cover and secure with the one posi-drive screw at the top.

   NOTE:

   **If the Input-to-Output Isolation Module is installed at a later date, perform the above procedure (except for step 4).**

## COMMUNICATION INTERFACE

To communicate with the Signal Conditioner from a remote terminal, the following pins from the P2 connector, located at the rear of the Signal Conditioner (see Figure 2-1), must be addressed:

**CAUTION**

**THESE EIGHT LINES OPERATE AT TTL LEVELS. THIS MEANS A TERMINAL'S RS232 PORT CANNOT BE DIRECTLY CONNECTED TO THE SIGNAL CONDITIONER.**

- CDIN ..... This is the receive serial data line. This line will receive serial data from an external source. It is located on C7 of the P2 connector.
- CDOUT ..... This is the transmit serial data line. This line will transmit serial data to an external source. It is located at C8.
- Digital Ground ..... This is the signal ground line. The digital ground is located at C13.
- Notify ..... This line indicates a change of status. The notify line will go low each time the status of the Signal Conditioner is updated. It will return to a high state when the status is read. This pin is located at C9.
- Address (4 bits) ... These four lines tell the Signal Conditioner which slot number it is in so it can respond to communication directed to it. These pins are located at C3 through C6 respectively.

The serial data lines are configured for a rate of 1200 baud with a format of 1 start bit, 8 data bits and 1 stop bit.

Normally the interface between the Signal Conditioner and the user terminal is a Gould 5900 Signal Conditioner Frame Assembly or 3000 Recorder (see respective manuals for cable connections). If the user has neither of these, and interface must be constructed to change the RS232 level to TTL level.

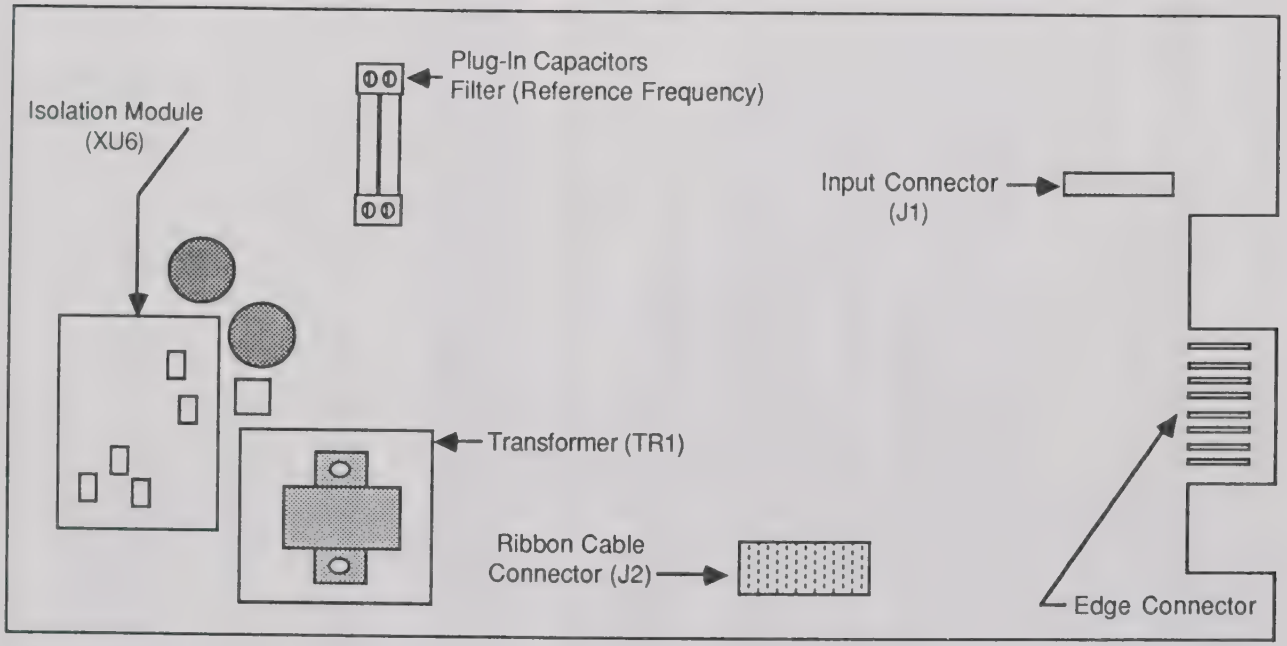


**FIGURE 2-3**
**MAIN AMPLIFIER BOARD**
**(Component Side)**

# OPERATION

## GENERAL

This section describes and illustrates the controls and their functions, provides operating instructions, and gives a functional test procedure for the programmable DC Signal Conditioners covered in this manual. The operating section is followed by Software Commands including format, mnemonics, bit stream and examples of using the software.

## CONTROL PANEL DESCRIPTION

Table 3-1 describes the functions and parameters of the front control panel keys, displays and LEDs. The item numbers in the table refer to the panel functions illustrated in Figure 3-1.

**TABLE 3-1**
**FRONT PANEL CONTROLS**

| ITEM | CONTROL | DESCRIPTION |
|---|---|---|
| 1 | DISPLAY | Vacuum Fluorescent Display: 4 1/2 digits, four decimal points; a minus ("-") sign; one display arrow on the right indicating volts. |
| 2 | INPUT FLOATING | LED ON indicates the Isolation Module is installed and the input signals and signal common are transformer coupled through the output. LED OFF indicates jumper board is installed and inputs are no longer floating. Caution must be exercised when the Signal Conditioner is operated in this mode. |
| 3 | SHUNT | LED ON indicates optional isolated shunt probe (connector) is installed. The display will automatically correct for the multiplying factor. LED OFF indicateds the optional probe is disconnected. |
| 4 | HV | LED ON indicates optional High Voltage probe (connector) is installed. The display will automatically correct for the multiplying factor. LED OFF indicates the HV is not connected and regualr input procedures should be in process. |
| 5 | REMOTE LOCK | LED ON indicates the Signal Conditioner is under external control only and front panel controls cannot change the setup. LED OFF indicates that either front panel switches or an external controller may be used to change setup. This function is activated only by a remotely controlled device. |

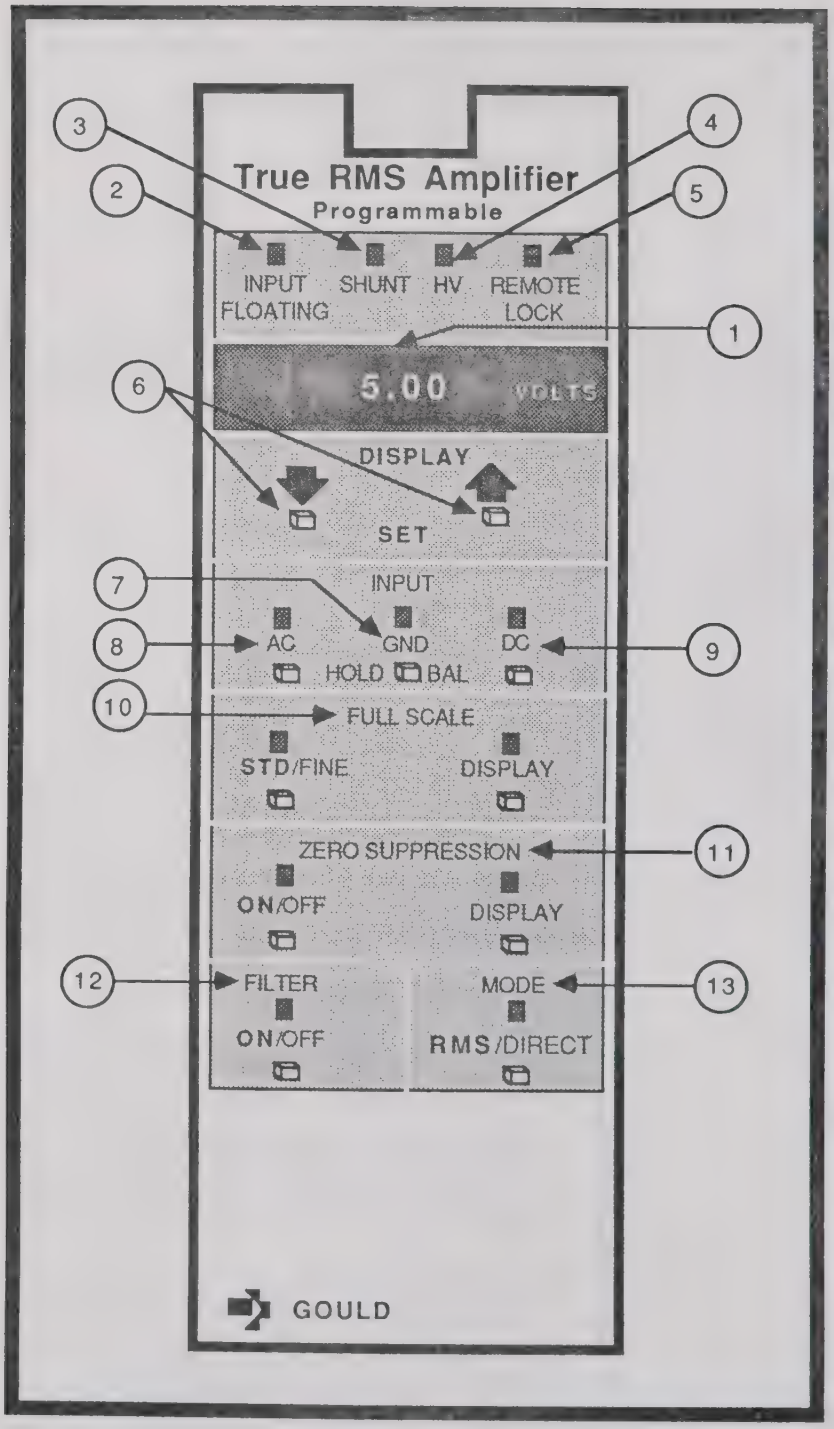


FIGURE 3-1
FRONT PANEL CONTROLS

| ITEM | CONTROL | DESCRIPTION |
|---|---|---|
| 6 | DISPLAY SET | Consists of two buttons which increases or decreases the value of the selected function voltage.<br><br>DOWN arrow button - pressing this key decreases the voltage value. Momentarily depressing the button will single step the value of the parameter. If the button is held, the display will automatically decrement the value.<br><br>UP arrow button - advances the voltage value. Momentarily depressing the key will single step the value. If the key is held, the display will automatically increment the value. |
| 7 | INPUT GND | Pressing this button disconnects the input signal from the input amplifier and grounds the input amplifier to the input common. Pressing and holding the button for two seconds causes the Signal Conditioner to perform an Auto Zero (balance) routine for the present Full Scale voltage setting. The display will show BAL during the Auto Zero procedure. If a Standard (**STD**) range is selected, the signal conditioner will retain that balance value in memory until the balance value is changed for that setting. If a Fine range is selected, the signal conditioner will retain the balance value until a Standard range is selected or the Fine range equals or exceeds the two Standard ranges that bracket the selected Fine range.<br><br>LED ON indicates the Signal Conditioner's inputs are connected to common. |
| 8 | AC | When this button is pressed, the input becomes AC coupled and Zero Suppression is turned OFF. LED indicates the input is AC coupled. |
| 9 | DC | When this button is pressed, the input becomes DC coupled. LED ON indicates the input is DC coupled. |
| 10 | FULL SCALE (volts) | |
| | a. **STD**/Fine | Momentary pressing of this button will cause the display to toggle between standard (STD) and FINE type of the FULL SCALE selection. If Zero Suppression is ON while the Full Scale function is active (LED for FULL SCALE DISPLAY is ON), then Full Scale is in the expand/compress mode. To return to the normal Full Scale value, turn Zero Suppression OFF.<br><br>The STD (coarse) mode enables the following standard range settings for full scale: 0.010, 0.025, 0.050, 0.100, 0.250, 0.500, 1.00, 2.50, 5.00, 10.0, 25.0, 50.0, 100.0, 250.0, 500.0, 1000, VFS.<br><br>FINE mode enables the FS voltage to be set through all values of the ranges: 0.010 thru 1.00 VFS in 0.001 V increments; 1.1 thru 10.0 VFS in 0.01 V increments; 10.1 thru 100.0 VFS in 0.1 V increments; 100.1 thru 1000.0 VFS in 1.0 V increments.<br><br>LED ON indicates the display is in the **STD** (standard) mode. |

| ITEM | CONTROL | DESCRIPTION |
|---|---|---|
| b. | DISPLAY | Momentarily pressing this button will cause the display to show the current volts Full Scale and allow the DISPLAY SET (6) buttons to be used to change the Full Scale Voltage |
| 11 | ZERO SUPPRESSION | |
| a. | ON/OFF | Successive pressing of this button will turn the Zero Suppression ON or OFF alternately.<br><br>LED ON indicates Zero Suppression is active. LED OFF indicates Zero Suppression is inactive.<br><br>If Zero Suppression is turned OFF, the Full Scale value will return to the range at which it was set before Zero Suppression was turned ON. |
| b. | DISPLAY | Momentarily pressing this button will cause the display to show the current value of the Zero Suppression setting and allow the DISPLAY SET (6) buttons to change the Zero Suppression voltage.<br><br>LED ON indicates the display is a Zero Suppression voltage. |
| 12 | FILTER | This is a fixed15 Hz low pass filter which is user adjustable allowing the user to change the value with plug-in capacitors. (See Installation Section.) |
| a. | ON/OFF | This is alternate action button. Momentarily pressing it either allows the filter to be ON or OFF. When in the OFF mode, the full bandwidth of the Signal Conditioner is selected.<br><br>LED ON indicates the filter is active. LED OFF indicates the filter is inactive. |
| 13 | MODE | This is an alternate action button switching the Signal Conditioner between the **RMS** and DIRECT modes.<br><br>In the **RMS** mode, the Signal Conditioner will calculate the RMS value of the input signal. The output ranges in the RMS mode are DC to 250 kHz for Full Scale up to 100 V, and DC to 100 kHz over 100 V. (See Appendix A, Specifications, for more data.) With pen recorders, the DIRECT mode should not be used when the input signal exceeds the bandwidth of the recorder.<br><br>In the DIRECT mode, the Signal Conditioner will instantaneously output the input signal in a range from DC to 10 kHz.<br><br>LED ON indicates the Signal Conditioner is in the **RMS** mode. |

**NOTE:**

**Provision for memory retention is provided for all front panel settings. The retention is activated when the AC power is turned off or the AC power is interrupted.**

## OPERATION

This section describes the setup and operation of the Signal Conditioner.

> **CAUTION**
>
> **ALL PROCEDURES OUTLINED IN SECTION 2, INSTALLATION, SHOULD BE COMPLETED BEFORE ATTEMPTING PRELIMINARY OPERATION.**

### Operation Setup -

1. When power is turned ON, all of the LEDs will light indicating there are no malfunctions in the Signal Conditioner circuit. All lights will then go out momentarily and the appropriate LEDs will light showing the Signal Conditioner preset position.

2. Push INPUT GND (LED should be on).

   **NOTE:**

   **To perform a zero offset (balance) of the Signal Conditioner, the INPUT GND button should be held for two seconds. The balance will only be performed for the selected Full Scale range. (See above description for the INPUT GND button).**

   **A zero offset (or balance) should be performed whenever the Signal Conditioner experiences an ambient temperature change of ±5° centigrade.**

3. Push Full Scale DISPLAY button. (LED should be ON.)

4. Push the Full Scale **STD**/FINE button. (LED should be ON.)

5. Turn the other functions OFF by pushing the button immediately below each LED.

6. Change the numerical value of the Full Scale display by pushing either the up arrow or down arrow so that the display goes from 1000 to 0.01. Experiment and return to 10.00 volts.

### Programming Parameters -

To program the Signal Conditioner for operation, the user must enter only one primary parameter, FULL SCALE. There are three supplementary parameters - ZERO SUPPRESSION, FILTER, and MODE - which provide additional functions extending the operation of the Signal Conditioner.

The parameter values for Full Scale which is entered below is used as an example to demonstrate the use of the Signal Conditioner; the user will, of course, input his own required value.

Primary Parameter -

Enter the FULL SCALE value as outlined below. The numbers and lower case letters which appear in parenthesis refer to item numbers in Figure 3-1.

1. Enter the FULL SCALE value. (The value in the display window will have the lighted arrow pointing to Volts when this function is active):

   a. Select the Full Scale (10) parameter by pushing the Full Scale DISPLAY button. The DISPLAY LED will be lit when this parameter has been properly selected.

   b. Use the standard rate to increment the value by pushing the **STD**/FINE button. The LED will light when the standard rate is active. (See the increment ranges for this key in the description of Front Panel Controls.)

   c. Using the two DISPLAY SET buttons (6) set the display to 10.00 (for 10 volts full scale).

Supplementary Parameters -

The three supplementary parameters - ZERO SUPPRESSION, FILTER and MODE - offer additional functions and extend the operation of the Signal Conditioner. They can be used separately or in combination with each other.

- ZERO SUPPRESSION -- The zero suppression parameter permits the steady-state component of a complex signal to be suppressed allowing the dynamic portion to be amplified and recorded in greater detail. To set the Zero Suppression parameter perform the following:

  a. Select the Zero Suppression (11) parameter by pushing the DISPLAY BUTTON in the Zero Suppression section. The LED for DISPLAY will be lit when this parameter has been properly selected.

  b. Turn the Zero Suppression function ON by pressing the button. The LED should be ON.

  c. Adjust the Zero Suppression value by pressing the DISPLAY button in the Zero Suppression section (11) and incrementing the value with the two DISPLAY SET keys (6).

  d. To expand or compress the signal, set Full Scale value to desired range (if not already selected) by pressing the Full Scale DISPLAY button (10) and changing the value with the two DISPLAY SET keys (6). The signal can now be expanded or compressed using the DISPLAY SET keys.

- FILTER -- The filter function can be used to eliminate or suppress any noise above the measurement frequency. To select a filter value perform the following:

  a. Turn the filter function by the pressing the ON/OFF button in the FILTER section (12). The LED should be ON.

  b. To select a different filter value, the user must install plug-in capacitors with different values. See Section 2, INSTALLATION.

- MODE - The MODE function allows the user to select either the **RMS** or DIRECT mode. In the **RMS** mode, the Signal Conditioner will calculate the RMS value of the input signal. In the DIRECT mode, the Signal Conditioner will instantaneously output the input signal. To select the RMS mode, push the button until the LED comes ON. The LED is OFF in the DIRECT mode.

## Preliminary Operation

Once all required parameters have been selected and programmed in the Signal Conditioner, the user can begin operation. To initiate a preliminary operation of the Signal Conditioner perform the following steps:

1. Power up the Signal Conditioner by turning it ON.

2. Select the FULL SCALE by pushing the DISPLAY button in the FULL SCALE (item 10, Figure 3-1) section. If the LED for **STD**/FINE is ON, the FULL SCALE value will change sensitivity by the standard settings when the DISPLAY SET (6) buttons are pushed.

3. Select a FULL SCALE value of 2.50 volts by toggling the DISPLAY SET buttons (6) up or down until 2.50 volts appears in the display window (1).

4. Connect the input cable to a voltage source of 0.50 volts peak-to-peak at 40 Hz with a +2 VDC offset. The input connector should be wired as follows:

   - pin 2 .....(+)
   - pin 9 .....(-)
   - pin 1 .....(common) tied to pin 9

5. Push INPUT GND button (7) to ground the input of the Signal Conditioner. The LED should be lit.

6. Set the recorder pen position to the right chart edge.

7. Set the input of the Signal Conditioner to the DC mode by pushing the DC (9) button. LED should be lit. The recorder pen should deflect towards the left chart edge. The 0.5 VAC component will deflect from from the 40 division mark to the 50 (FULL SCALE) division.

   NOTE:

   **When either the AC or DC button is pushed and the signal conditioner receives an overload at the selected range, the message 'OVERLOAD" will be displayed.**

8. If only the AC component is important, the DC level can be suppressed by pushing the ZERO SUPPRESSION (11) ON/OFF button (LED should be lit) and then the DISPLAY button. Set the display to 2.00 volts by toggling the DISPLAY SET buttons (6). The AC signal will now appear from the chart edge to 10 divisions. The signal may now be expanded to 0.5 volts full scale by changing the FULL SCALE (10) sensitivity to 0.500 volts. The signal will now vary from 0 to 50 divisions.

   AC coupling may also be used to eliminate unwanted DC levels. It must be noted that the frequency response must be above 2.5 Hz for AC coupling to be useful.

9. If the user wishes to record the RMS levels of the input signal, the **RMS**/DIRECT button should be pressed until the LED comes ON. The DIRECT mode should not be used when the input signal exceeds the bandwidth of the pen recorder.

## SOFTWARE COMMANDS

### General

The following paragraphs describe the software commands, mnemonics, and their functions which are used when the 56-1302-00 Signal Conditioner is installed in a Gould 5900 Signal Conditioner Frame Assembly. Information on the bit stream format and examples for executing software commands appear at the end of the section.

### Command Format

The software program for the 5900 Signal Conditioner Fame Assembly (or Gould 3000 Recorder) uses the following format to execute commands:

- The letter "**n**" in specific commands indicates the desired slot number. A space must be entered between the command and slot number.
- When sending multiple commands, each command must be separated by a semicolon (";").
- When sending commands via the 3000 recorder interface, each command or command string must be preceded by the command "**PC;**".
- Each line should be terminated with a carriage return "<cr>".

### Command Set

Table 3-2 is a list of the available commands for the Signal Conditioner. Table 3-6 is a description of the commands and their functions.

**TABLE 3-2**
**LIST OF SOFTWARE COMMANDS**

| Name | Command |
|---|---|
| | |
| Clear Notify Status Register | CN |
| Pass Command | PC |
| Prompt Enable | PE |
| Prompt Disable | PD |
| Receive Status | RS n[<Bit-Stream>] |
| Send Amp (Mnemonic) | SA n[<Mnemonic>] |
| Send Configuration | SC |
| Send Notify Status Register | SN |
| Send PMD Header | SH n |
| Send PMD | SP n |
| Send PMD Length | SL n |
| Send Slot Mask | SM |
| Send Status | SS n |
| Send Tag | ST n |
| Send Who Configuration | WH |
| Zero Offset | ZA n |

## TABLE 3-3
## DESCRIPTION OF SOFTWARE COMMANDS

| Name | Command | Description |
|---|---|---|
| Pass Command | PC | Passes a command or a string of commands received by the 3000 Recorder to the 5900 Frame Assembly. When used in a string, all commands following it will be sent to the Signal Conditioner and all commands preceding it are for the recorder. In a stand alone 5900 Frame Assembly where this command is received via the 5900's own interface, it is recognized and ignored.<br><br>Send: **PC;**<command(s)> |
| Prompt Enable | PE | Enables the 5900 (or 3000 Recorder) prompt for discrete terminal use using RS-232-C transmission. The initial "power on" default is Prompt Disable. In this state, command characters received are characters which will NOT be echoed back. The initial execution of this command will display an "Interface Set-Up Okay" message along with the prompt, character ">". In this mode, all command characters will be echoed back to the screen.<br><br>Send: **PE** |
| Prompt Disable | PD | Disables the prompt and returns the 5900 (or 3000 Recorder) to its default communication mode.<br><br>Send: **PD** |
| Send Slot Mask | SM | Queries the 5900 Frame Assembly to indicate which slots are occupied. Operator will receive a byte for every four slots, e.g., a two or four Frame Assembly will respond with two status bytes. The data is displayed in a hexadecimal format and left justified, where a "**1**" indicates the presence of a Signal Conditioner when the byte is converted to binary.<br><br>Example:<br><br>If user has an eight channel 5900 Frame Assembly and slots 1 thru 6 are occupied, a 2 status bytes "FC" would be received when the command was sent.<br><br>**Slot 1 2 3 4 5 6 7 8** = **FC**<br>1 1 1 1 1 1 0 0<br><br>Send: **SM**<br><br>Receive: <byte1> <byte2> |

| Name | Command | Description |
|---|---|---|
| Send Configuration | SC | Queries the 5900 Frame Assembly to send the available options which are configured into the Frame Assembly. The response will be an ASCII text format. Works in the PE mode only.<br><br>Send: **SC**<br><br>Receive: <ASCII string> |
| Send Who Configuration | WH | Queries the Frame Assembly to send information on what type of Signal Conditioners are installed in the Frame Assembly. The 5900 will respond with the device number, the slot mask, followed by the device numbers nested in it in a left justified order. The Device Codes for the Signal Conditioners are: 100 = 56-1340 (and 1440); 200=56-1302 (1300) fixed filter; 201=56-1302; 202=56-1301; and 203=56-1300 programmable filter.<br><br>Example:<br><br>If the 5900 Frame Assembly is loaded with three Signal Conditioner -- a 5600IS in slot 1, a 5600 DC in Slot 3; and a 5600 bridge in slot 7 -- the response would be '5900;A2;100;200;202;'<br><br>Send: **WH**<br><br>Receive: <Who Configuration String> |
| Send Notify Status Register | SN | Queries the 5900 Frame Assembly to let user know if someone has changed the last known setup from the Signal Conditioner's front panel controls. It will NOT tell what has been changed but will tell in which Signal Conditioner (in what slot) the change occurred. The data response is similar to the "Slot Mask" except here a binary "**1**" indicates a change.<br><br>Example:<br><br>If the Signal Conditioner's setup has been changed from the front controls on slots 1, 2, 5 and 8, the response would be "**C9**"<br><br>Send: SN<br><br>Receive: <byte1> <byte2><br><br>**Note:**<br><br>**This feature does NOT tell how many time a certain Signal Conditioner has been changed. Once its bit has been set to "1", it will remain there until the register is cleared by sending the CN command.** |

| Name | Command | Description |
|---|---|---|
| Clear Notify Status Register | CN | Clears the internal notify status register. This command should be executed following the **SN** command which allows the Notify Status Register to be received.<br><br>Send: **CN** |
| Send Status | **SS n** | Queries the Signal Conditioner in slot n for its status. The response will be an ASCII string representing the current front panel status. See the Signal Conditioner bit stream information for decoding the string.<br><br>Send: **SS n**<br>Receive: <Bit-Stream> |
| Send PM Header | SH n | Queries Signal Conditioner "n" for its PMD (Personality Module Definition) and responds with PMD header data received. The "n" can be any number from 1 to 8, corresponding to the slot or channel which the desired Signal Conditioner occupies. |
| Send PMD | SP n | Queries Signal Conditioner "n" for its resident PMD and responds with PMD data received. The "n" can be any number from 1 to 8, corresponding to the slot or channel which the desired conditioner occupies. |
| Send PMD Length | SL n | Queries Signal Conditioner 'n" for its PMD length and responds with PMD length data received. The "n" can be any number from 1 to 8, corresponding to the slot or channel which the desired conditioner occupies. |
| Receive Status | RS n | Allows user to "program" or set up the Signal Conditioner with new status. The "n" can be any number from 1 to 8, corresponding to the slot or channel in which the desired Signal Conditioner occupies; or "n" can be an "A" in which case all Signal Conditioners will be programmed. The status data is defined by the Signal Conditioner. In the "PD" or communications default mode, the response will be an ASCII <ACK> or <NAK> depending on the error or valid data. In the "PE" mode, the response will vary in error message, or a "Command Data Received" message will be displayed validating the status data sent and signal conditioner action to it.<br><br>Send: **RS n**<Bit Stream><br>Receive: <valid or not not valid message> |
| Send Tag | ST n | Queries the Signal Conditioner in slot "n" for its status. The response will be the Signal Conditioner's status in a text format (ASCII string). See **NOTE** on the next page.<br><br>Send: **ST n**<br>Receive: <signal conditioner's status in a text format> |

| Name | Command | Description |
|---|---|---|
| Send Amp (Mnemonic) | SA n | Enables programming of Signal Conditioners by Signal Conditioner mnemonics, either individually or globally. Allows user to change a specific status parameter for the Signal Conditioner in slot "n". The mnemonic data is defined by the specific Signal Conditioner used (see Mnemonic List). If the prompt is disabled, the response after sending the mnemonic will be an ASCII ACK or NAK depending on err or valid data. If the prompt is enabled, the response will vary in error message, or a "Command Data Received" message will be sent validating the status data sent. User can specify all Signal Conditioners to be changed by using an "A" for the slot number field.<br><br>Send: SA n<Mnemonic><br><br>Receive: <valid or not valid message> |
| Zero Off Adjust | ZA n | Recalibrates the specified Signal Conditioner's zero offset. The "n" can be any number from 1 to 8, corresponding to the slot or channel in which the desired signal conditioner occupies. |

NOTE:

**When the command "Sent Tag" is sent via a remote terminal (or AMP PRINT key is pushed on the 3000 Recorder), the current status of the Signal Conditioner will be printed out listing the parameters and values that have been entered for the selected mode. The FULL SCALE value is printed first. Any parameters not entered or functions not selected will not be listed in the status message. The following is a typical example of the status message printed for the Signal Conditioner:**

**FS=5.00V ZS=3.00V FILTER=ON GND-COUPLED**

**The above example describes a Signal Conditioner status with a Full Scale value of 5 volts; Zero Suppression is ON with a value of 3 volts; and Filter is on. Note that because the Isolation Module was not installed the function INPUT-FLTG was not listed.**

### Mnemonic List

Table 3-4 is a list of mnemonics used with software commands for 56-1302-00 Signal Conditioner when it is installed in Gould's 5900 Signal Conditioner Frame Assembly or Gould 3000 Recorder.

**TABLE 3-4**
**MNEMONICS FOR 56-1302-00**

| Parameter | Mnemonic | Input Function or Value as: |
|---|---|---|
| Balance (Zero Offset) | BAL | BAL1=balances the Signal Conditioner at the current volts Full Scale value. |
| Coupling | COU | COUØ=enable DC coupling<br>COU1=enable AC coupling<br>COU2=enables GND coupling |
| Filter | FIL | FILØ = disable filter<br>FIL1= enable filter |
| Remote Lock | RLK | RLKØ = disable remote lock<br>RLK1 = enable remote lock |
| volts Full Scale | VFSn | Sets the volts Full Scale parameter to the value specified as "n" where "n" can be any value in the following ranges:<br><br>High Voltage Probe - 10 to 2500 volts.<br>Shunt Probe - 0.0010 to 0.500 volts.<br>Neither probe used and Signal Conditioner is not floating - 0.010 to 100.0 volts.<br>Neither probes used and Signal Conditioner is floating - 0.010 to 1000 volts.<br><br>(Floating indicates the presence of the input-to-output isolation module.) |
| Zero Suppression | SUP | SUPØ = disable zero suppression<br>SUP1 = enable zero suppression |

| Parameter | Mnemonic | Input Function or Value as: |
|---|---|---|
| Zero Suppression Value | ZSVn | Sets the Zero Suppression parameter to the value specified as "n" where "n" can be any value in the following ranges:<br><br>High Voltage Probe: -2500 to 2500 volts.<br>Shunt Probe: -0.500 to 0.500 volts.<br>Neither probe used and Signal Conditioner is not floating : -100.0 to 100.0 volts.<br>Neither probe used and Signal Conditioner is floating: 0.010 to 1000 volts. |

### Bit Stream Format

The following paragraphs and Table 3-5 describe the bit stream format used with the 56-1302-00 Signal Conditioner. The bit stream is composed of 16 characters. The first three characters use a HEX format. The characters from 4 thru 8 are used to designate volts Full Scale values, and characters from 9 thru 14 for Zero Suppression. When assigning values to these characters (4 thru 14), the rest of the field must be filled with zeroes or spaces. Characters 15 and 16 are not used.

Table 3-5 lists the character position in the bit stream; the bits, if required, that comprise the character; the parameter that the character defines; the function and/or value that can be entered with the character; and the character type which will be one of the following:

(W) - write only
(R) - read only
(A) - read and write
(U) - undefined (not used)

**TABLE 3-5**
**BIT STREAM CHARACTERS**

| CHARACTER POSITION | | PARAMETER | FUNCTION/VALUE | TYPE |
|---|---|---|---|---|
| 1 | Bit Ø & 1 | Coupling | ØØ=DC | (A) |
| | | | Ø1=AC | (A) |
| | | | 1Ø=GND | (A) |
| | Bit 2: | Zero Suppression | Ø=OFF; 1=ON | (A) |
| | Bit 3: | Filter | Ø=OFF; 1=ON | (A) |
| 2 | Bit Ø: | Input Floating | Ø=OFF; 1=ON | (R) |
| | Bit 1: | Remote Lock | Ø=OFF; 1=ON | (A) |
| | Bit 2 : | Shunt Probe | Ø=OFF;1=ON | (R) |
| | Bit3: | High Voltage Probe | Ø=OFF;1=ON | (R) |
| 3 | Bit Ø | Not Used | | (U) |
| | Bit 1 | Over Load | Ø=No Over Load | (R) |
| | | | 1=Over Load | (R) |
| | Bit 2 | RMS | Ø=OFF;1=ON | (A) |
| | Bit 3: | Auto Balance | Ø=OFF;1=ON | (W) |

| CHARACTER POSITION | PARAMETER | FUNCTION/VALUE | TYPE |
|---|---|---|---|
| 4 thru 8 | Volts Full Scale | Ranges are as follows:<br>High Voltage Probe .....10 V thru 2500 V<br>Shunt Probe .....0.0010 V thru 0.500 V<br>Input Floating .....0.010V thru 1000 V<br>Input Not Floating .....0.010 v thru 100 V | |
| 9 thru 14 | Zero Suppression | Ranges are as follows:<br>High Voltage Probe .....-2500 V thru 2500 V<br>Shunt Probe .....-0.500 V thru 0.500 V<br>Input Floating .....-1000 V thru 1000 V<br>Input Not Floating .....-100 v thru 100 V | |
| 15 | Not Used | | (U) |
| 16 | Not Used | | (U) |

**Sample of Software Command Application**

The following example illustrates the use of the 56-1302-00 Software Commands in a typical application. The first paragraphs describe how the commands would be entered using the front panel. The paragraphs following the front panel setup describe how those same parameter values would be entered using the software commands. The configuration to be used in this example is:

- Input.....DC Coupled
- Full Scale .....5 volts
- Zero Suppression.....On
- Suppression Value.....75 Volts
- Filter .....On

Setup using Front Panel Controls -

To enter the above parameter values using the front panel keys, perform the following:

1. Ground the input by pressing the INPUT GND button. The LED should be ON.

2. Make certain the Zero Suppression is OFF by pressing the Zero Suppression ON/OFF button. The LED should be OFF.

3. Press the Full Scale DISPLAY button until LED goes ON. Push the Full Scale **STD**/FINE until LED comes on and using the two DISPLAY SET buttons increment the display until it reads 5.00 volts.

4. Turn on Zero Suppression by pressing the Zero Suppression **ON**/OFF button. The LED should be ON.

5. Press the Zero Suppression DISPLAY button until LED goes ON. Using the two DISPLAY SET buttons change the display until it reads 75 volts.

6. Turn on the filter by pressing the FILTER **ON**/OFF button. The LED should be ON.

7. DC couple the input. Press the DC button until the LED goes On.

Setup using Software Commands -

To set up the 56-1302-00, in Slot 1, using software commands perform the following via a computer terminal:

| | | |
|---|---|---|
| 1. | PC;SA 1[COU2]<CR> | Grounds the input. |
| 2. | PC;SA 1[SUPØ]<CR> | Makes sure Zero Suppression is OFF. |
| 3. | PC;SA 1[VFS5]<CR> | Sets Full Scale to 5 volts. |
| 4. | PC;SA 1[SUP1]<CR> | Turns Zero Suppression On. |
| 5. | PC;SA 1[ZSV75]<CR> | Sets Zero Suppression value to 75 volts. |
| 6. | PC;SA 1[FIL1]<CR> | Turns the filter ON. |
| 8. | PC;SA 1[COUØ]<CR> | DC couples the input. |
| 9. | PC;ST 1<CR> | Enters a Sent Tag message requesting status. |

After entering the last line, a "Sent Tag" request, the message sent back should read:

FS=5 ZS=75 FILTER=ON DC-COUPLED INP-FLTG

NOTE:

**With a 5900, the data will be send back in two ways depending on whether the terminal is in the Prompt Enabled or Prompt Disabled mode. With Promp Enabled, the status will be sent as follows:**

**XOFF LF CR SPC <status> XON LF CR >**

**With the Promp Disabled, the line will be sent as follows:**

**XOFF STX <status> ETX XON**

## ERROR MESSAGES

This display is used to alert user for possible fault conditions:

Err-0 .....No isolator or jumper board.
Err-1 .....Indicates bad microprocessor.
Err-2 .....Indicates bad RAM.
OL.....Indicates the Signal Conditioner is over loaded.

# MAINTENANCE

## INTRODUCTION

This section describes the preventive maintenance that should be performed annually on the 56-1302-00 Signal Conditioner. If the Signal Conditioner is used in a dusty or dirty environment the maintenance periods should be more frequent. If the unit requires calibration, refer to the service manual on the 56-1302-00 or consult your Gould Service Representative. A list of accessories follows the preventive maintenance section. A full statement of Gould Warranty and a list of Gould's Sales and Service Offices concludes the section.

## CLEANING

### Front Panel

Wipe off the front panel including the display window and keys with a damp rag using a mild soap. Allow the panel and keys to thoroughly dry before placing the unit in operation.

### Input Connector

Clean the pins and inside of the connector with isopropyl alcohol (with 90% alcohol content). A damp rag with mild soap may be used on the outside of the connector and the release mechanism. (See Figure 4-1.) Allow the connector, pins, and release mechanism to air dry.

### Printed Circuit Boards

Any accumulated dust or dirt must be removed from the Main Amp and Status Control boards for the Signal Conditioner to operate properly. To access the boards for cleaning, perform the following procedure:

1. Turn power OFF to the Signal Conditioner Frame Assembly with the power switch (located in the rear of the unit).

2. Disconnect the input connector plug by pushing on the release mechanism. See Figure 4-1.

3. Loosen the extractor (see Figure 4-2) located at the bottom of the slot by turning the screw counterclockwise. Pull on the extractor until the Signal Conditioner releases.

4. Carefully slide the entire Signal Conditioner from the cage.

5. Remove the right-hand side cover (as view from the front of the unit) by unscrewing one posi-drive #4-40 screw located at the top of the cover flange. See Figure 4-1. Remove the side cover by pulling up and out from the conditioner case.

6. Unscrew five posi-drive #4-40 screws from the Status Control board (on the right-hand side).

7. Lift the board gently from the case and allow it to swing back toward the front panel. The board cannot be completely removed from the Signal Conditioner case because a short ribbon cable (26-

pin) connects the Status Control board to the Main Amplifier board. Carefully unplug the connector (J2) at the Main Amplifier board permitting the Status Control board to be swung out of the enclosure and the Main Amplifier board to be accessed.

8. Wipe off the boards with a clean, dray rag. Spray both boards with Micro Care Polar Flux Remover. Allow the boards to air dry.

9. Connect the cable from the Status Control board to the Main Amplifier board. Make certain the connector is properly seated. Position the Status Control board in the Signal Conditioner. Secure the board with the five posi-drive #4-40 screws.

10. Replace the right-hand side cover and secure with the one posi-drive screw at the top.

11. Slide the Signal Conditioner into the cage until it makes contact with the backplane connector. It will then require a little force to seat the the Conditioner into the backplane connector. The front panel of the Signal Conditioner should be flush with the front panel of the Frame Assembly.

12. Lock the extractor by pushing it in and tightening the screw.

13. Install the input connector plug at the back of the Signal Conditioner by pushing it on and making certain the release mechanism has engaged.

## ACCESSORIES

The following is a list of accessories available for the 56-1302-00 Signal Conditioner.

- High Voltage Probe (Connector Assembly):

  This probe extends the Signal Conditioner's to 1500 V. Part No. CL-810414.

- Isolated High Voltage Shunt (Connector Assembly):

  This probe is used to make current measurements (shunt) at common mode voltages up to 1500 V. Part No. 810413.

- Isolation Module Kit (Installed) ..... Part No. 11-4220-01.

- Jumper Board ..... CL-810287.

- Cable..... Use Belden 83393 or equivalent.

- Input Connector Plug ..... Mounted on the rear of the signal conditioner, **BANTAMATE (BURNDY)** 12 pin connector. (See Fig. 4-1 for location and connections). Part No. CL-611668.

- I/O Connector ..... 48 pin DIN. Power, control signal I/O.

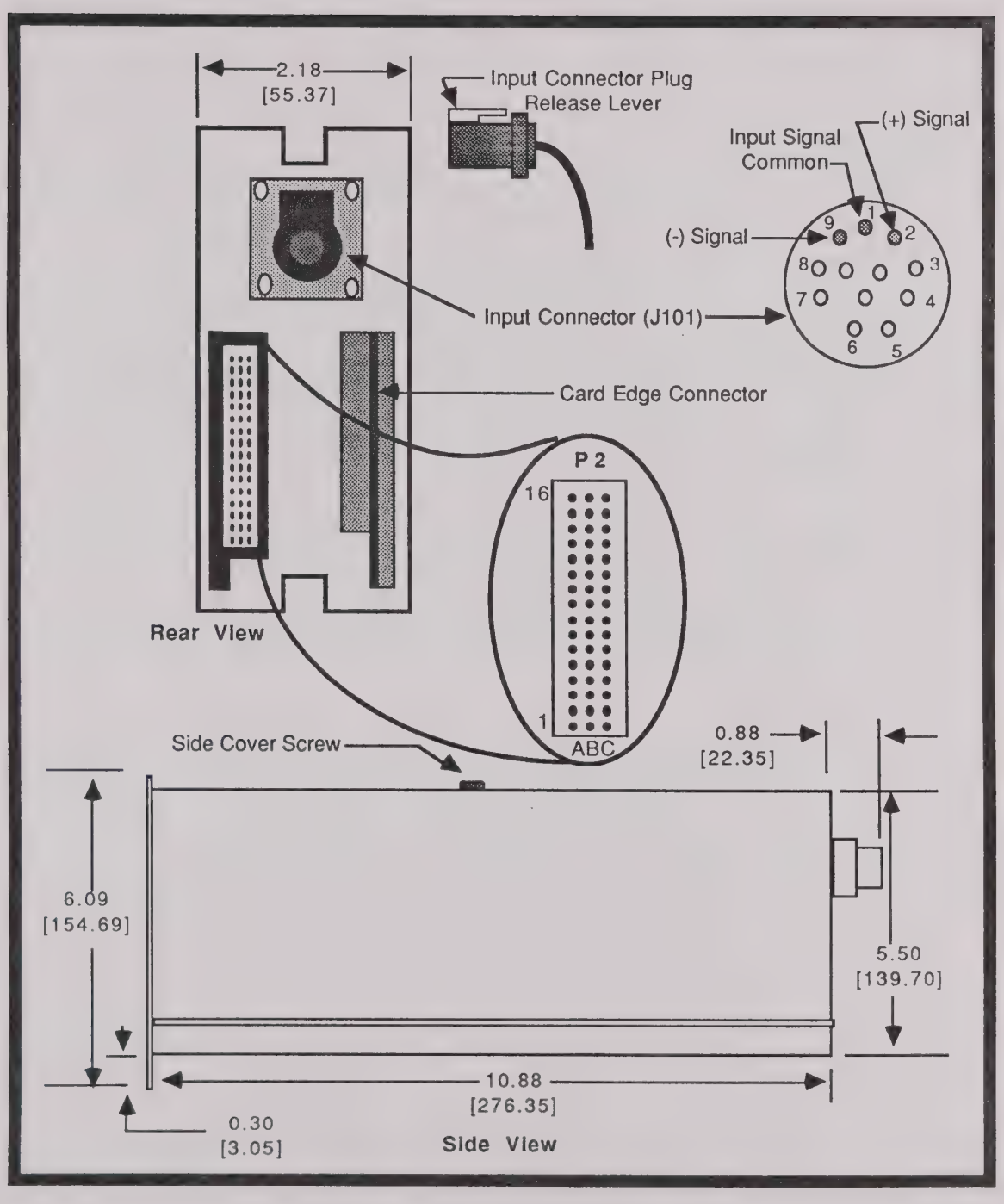


FIGURE 4-1
56-1302-00 SIGNAL CONDITIONER
(Rear and Side Views)

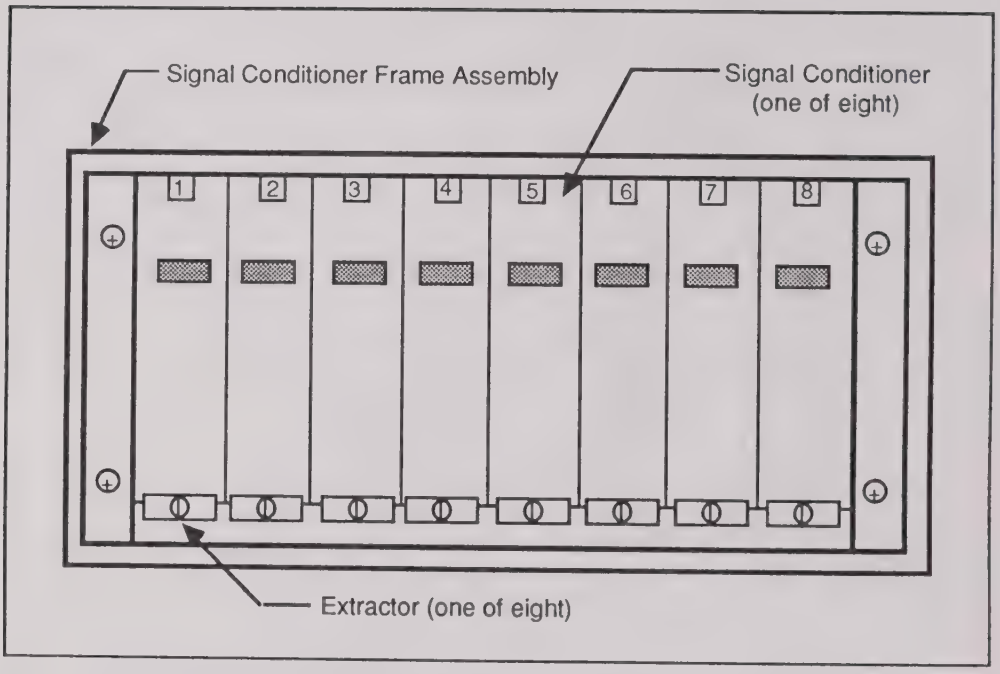


FIGURE 4-2
SIGNAL CONDITIONER FRAME ASSEMBLY
(Front View)

# WARRANTY

## CURRENT EQUIPMENT

Gould Inc., Recording Systems Division's products as shown in the Current Equipment Catalog are warranted for a period of one year from date of shipment to original purchaser. Exceptions: The IBM PC-XT computer for Data Acquisition Systems (DASA) and their associated software programs are warranted for 90 days. The IBM PC-AT computer is warranted for one (1) year.

Gould's products are warranted to conform to the applicable published specifications in effect at the time of shipment, and to be free from any defects in material or manufacture when used with recommended Gould associated equipment and Gould chart paper. GOULD'S LIABILITY UNDER SUCH WARRANTY IS LIMITED TO SERVICING OR REPLACING DEFECTIVE PARTS EXCEPT PENS, STYLI, FUSES AND BATTERIES AND DOES NOT INCLUDE CALIBRATION AND MINOR MAINTENANCE AS OUTLINED IN GOULD OPERATING MANUALS. IN NO EVENT SHALL GOULD BE LIABLE UNDER CONSEQUENTIAL OR SPECIAL DAMAGES. All products are to be returned transportation prepaid by the buyer. Gould reserves the right to determine the cause and existence of a defect under this warranty and this warranty shall not apply to any products which have been subjected to misuse, improper installation, repair, alteration, neglect, accident, inundation, fire or operation outside their published maximum ratings.

THE FOREGOING WARRANTY IS EXCLUSIVE AND EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS AND OF ANY OTHER OBLIGATION AND SHALL CONSTITUTE THE SOLE REMEDY OF THE BUYER AND SOLE LIABILITY OF GOULD.

Gould offers an Extended Warranty Agreement for all its products, along with calibration traceable to NBS. Please contact the Service Center listed on the following pages for details before your warranty expires.

## REPLACEMENT PARTS

Warranty is same as above except ninety (90) days from date of shipment. **Gould** instruments are individually tested and calibrated before shipment to assure dependability and verify their accuracy. To this procedure must be added an unseen ingredient of prime importance to you: the Gould concept of continuing service. Gould responsibility for each instrument sold covers far more than its delivery. Of equal concern is the equipment's suitability for its intended purpose, its correct installation, instruction of operating personnel -- plus future servicing and maintenance. The Gould Field Service Department offers customers any or all of these services:

### Field Service

Installation
Field maintenance
NBS Certification

### Training

Instruction of operators
On-site training seminars
Formal Training courses

### Service Contracts

Fixed Fee
Time and Material
Extended Warranty

### Our Seal of Pride

Gould Inc., Recording Systems Division and its predecessor organizations tracing back to Charles F. Brush, have been preeminent in instrumentation development since the 1920s. Among Gould's many achievements is a series of the world's best performing, most versatile, and reliable direct writing recording systems.

Today, Gould recorders and signal conditioners are the overwhelming choice for recording analog signals in the most critical industrial, scientific, and biophysical measurement applications. Whether recording the faintest life signals of a patient in a hospital operating room or the most critical variables in the laboratory or on the production line, you can depend on the accuracy, faithfulness, clarity, and permanence of the traces made by Gould MK200A System. Innovative design, coupled with highest quality, are hallmarks of all Gould products.

### The Field Service Engineer

Gould field service engineers provide on-the-spot assistance whenever and wherever it is required. While every field service engineer is the product of intensive and thorough factory training, you will find that his greatest strength evolves from field experience and his knowledge of your objectives. He is aware of your problems, is willing and able to assist you in their solution, and is backed by the nation's most experienced organization in recording instrumentation.

Our field service engineers and technicians are daily engaged in the installation, testing, maintenance, repair and inspection of Gould recording systems all over the country. They can provide you with any information about our instruments you may require; if not, they will find the answer to your problem.

### Overhaul and Repair

Because we service only our own products, our customers can feel confident of prompt, effective results when they turn to Gould Factory Service Centers.

The repair service these centers provide is of particular appeal to those companies that do not operate an instrument repair facility of their own. By designating the nearest Gould Service Center as its maintenance depot, a Gould-equipped company is assured the best chance for continuity of recording instrumentation.

Many companies with their own repair facilities find it more convenient and more truly economical to have their Gould equipment repaired by service contract with the closest Service Center. In addition to enjoying fast turn-around, these companies are spared the expense of carrying an inventory of recorder parts, accessories, and supplies.

## Calibration and Certification

A small, quiet room in the Standards and Calibration Section at the Gould plant in Cleveland contains precision reference standards just one step removed from the prime reference measurement standards of the United States - at the National Bureau of Standards in Washington. Included in this room, which is temperature-controlled within one degree and has a constant relative humidity of 40%, are standards for voltage, frequency (derived from the atomic vibration of caesium), resistance, capacitance -- in fact all basic parameters of electrical measurement. The room is maintained under stabilized conditions 365 days a year.

The calibration practice of all Gould Service Centers is directly traceable to the National Bureau of Standards. We can supply complete calibration for any Gould equipment, and we can also certify to manufacturer's specifications followed by a letter of certification when required.

## Training

The Gould field service engineer will hold short training courses either on the job or at his facility. On-the-job training is usually a brief, informal session with the people who will actually be operating the Gould equipment.

Formal classroom training is more complete: detail information, a thorough review of underlying theory, training devices, demonstration of problem solving and examination of students to determine their understanding and proficiency is accomplished at our Cleveland plant.

## Contracts

Companies of customers requiring temporary or permanent service are afforded contractual arrangements by which agreed-upon maintenance, repair upgrading and calibration services are performed on a routine basis. Service contracts are now in effect with a number of customers, affording substantial saving in time and money.

Owing to the various requirements of each customer, we do not reproduce here a standard, boilerplate agreement -- which might contain too much or too little. Instead, we tailor each contract to a particular customer's needs. This practice has single handedly produced substantial savings in time and money for others; and it can do the same for you.

An extended warranty is available at the point of sale allowing a regulated budget for the first two years of ownership. You may take advantage of this warranty within the first year of ownership at a percentage of the current listed price.

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Phone: 011-49-6182-8010
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# SPECIFICATIONS

## Input Circuit Configuration

Differential and balanced to cirucit common.

| | |
|---|---|
| Coupling | AC/GND/DC |
| Inpedance: | |
| Differential | 2 megohms shunted by 22 pF. |
| Single-ended (either input to common) | 1 megohms by 45 pF. |
| Bias Current (either input) | less than 500 picoamps. |

## Maximum Safe Voltage

Maximum Input Signal Voltage:

| | |
|---|---|
| Maximum Overload Voltage - | |
| For FS less than or equal to 1.00 VFS | 100 VRMS |
| For FS greater than 1.0 VFS to 1000.0 VFS | 750 VRMS each input to common or 1000 VRMS between inputs. |
| Maximum Common Mode Voltage - | |
| Input common to output common | 1500.0 V peak AC or 1000.0 DC |
| Output common to chassis common | 0.1 uF/1000 V is connected between output common to chassis. |

## Full Scale Input Voltage

| | |
|---|---|
| Measurement Range | 10 mV to 750 RMS Full Scale. |
| Standard (Full Scale Ranges) | 10, 25, 50,100, 250, 500 mV<br>1, 2.5, 5, 10, 25, 50, 100, 250, 500,1000 V Full Scale. |

Fine:
(Variable Sensitivity)

1 mV steps between 0.01 VFS to 1 VFS.
10 mV steps between 1.01 VFS to 10 V FS.
100 mV steps between 10.1 VFS to 100 VFS.
1 V steps between 100.1 VFS to 1000 V FS.

**Amplifier Isolation Voltage - (Common Mode Signal)**

Commons (when used with a 5900 Signal Conditioner Frame Assembly):

Inputs to Output: ..... 1500 V peak AC or 1000 DC

Ouput to Chassis ..... Is NOT isolated.

**Zero Suppression**

Range ..... ±0.0 V. to ±1000.0 V.

Expansion (maximum Full Scale Sensitivity vs Suppression Voltage):

| Suppression Voltage | Maximum Full Scale Sensitivity |
|---|---|
| ±0.0V ≤ S.V. ≤ ±1.0V | 0.010V |
| ±1.0V < S.V. ≤ ±10.0V | 0.1V |
| ±10.0V <S.V.≤ ±100.0V | 1.0V |
| ±100.0 < S.V. ≤ ±1000.0V | 10.0V |

Resolution (minimum step size versus suppression voltage):

Total No. of Bits ..... 16 including sign.

Displayed ..... 11 bits including ± sign or ± 10 bits not including sign (resolution as seen on front panel display).

| Suppression Voltage | Displayed Minimum Step Size |
|---|---|
| For FS < 1.0V -1.0V ≤ SV ≤ +1.0V | 0.001V / step |
| For 1.0V < FS <10.0V -10.0V ≤SV≤ +10.0V | 0.01V / step |
| For 10V < FS < 100.0V -100V ≤ SV ≤ +100V | 0.1V / step |
| For 100V < FS ≤ 1000V | 1.0V / step |

Not Displayed ..... 5 bits (32 counts NOT DISPLAYED between displayed steps, for fine setting of the pen on grid lines).

Stability:

Drift with Temp ..... ±0.01% of reading/°C.

Drift with Time ..... ±0.0025% of reading/24 Hrs.

Change with Line..... ±0.002% of reading/10% line change (when used with 5900 series Signal Conditioner Frame

Inaccuracy..... ±0.1% of full scale suppression voltage.

Non-Linearity..... ±0.05% of Zero Suppression Full Scale.

Zero Suppression Full Scale is:

±1.00 V for ranges ≤ 1.0 VFS.
±10.0 V for ranges between 1.0 VFS and 10.0 VFS.
±100.0 V for ranges between 10.0 VFS and 100.0 VFS.
±1000.0 V for ranges between 100.0 VFS and 1000.0 VFS.

NOTE:

**The x1, 10 and x100 input divider is used by both the Volts Full Scale and the Zero Suppression Voltage selectors to extend their measurement range. Therefore there is an interdependence between the functions.**

**Amplifier Output**

Stable (no Oscillation) with a load of 2 kohms or greater shunted by a 0.002 microfarad capacitor or less with a 10 kHz sinewave, 5 V peak-to-peak or less.

Circuit Configuration ..... Single ended to common.

Voltage..... maximum voltage swing: ±6.0 V linear with 2 Kohm

DC Inaccuracy..... ±0.25% of output Full Scale.

DC Nonlinearity ..... ±1.15% of output Full Scale.
(best straight line fit)

Impedance (typical)..... less than 1 ohm DC to 10 kHz.

Stability (after 15 minute warmup):

Zero with Temperature (referred to input) :

±20 microvolts/°C.
±8 microvolts/°C. typical.
±6 microvolts Root Sum square/°C.

Zero with time (referred to input) ..... Less than 50 microvolts/24 Hrs.

Zero with line (referred to input) ..... ±0.05% of Full Scale for a ±10% line change.

Gain with temperature ..... ±0.015%/°C.

| | |
|---|---|
| Gain with time | 0.03%/10,000 hrs. |
| Gain with line | ±0.01% for a ±10% change. |
| **Converter Output:** | |
| Circuit Configuration | Single ended to common. |
| Voltage | 10 mV to +5 V linear range. (These values are for converter output only.) |
| Inaccuracy | Referred to 1 VFS, Vin=1 VRMS, f=1 kHz, sine wave. |
| Calibration | ±0.1% of Full Scale. |
| Non Linearity | 0.05% of Full Scale. |
| Drift with Temperature | 0.05mV/C |
| Rise Time (rise time only): | |
| Filter OFF | less than 15 ms. |
| Filter ON | less than 30 ms. |
| Auto Zero Balance | Zero balance is automatic after a two second pressing of the GND button. |
| Resolution | will set the output to less than ±0.1% of Full Scale (±5 millivolts referred to output). |
| **Frequency Response:** | |
| RMS Mode | DC to 250 kHz for Full Scale up to 100 V.<br>DC to 100 kHz for Full Scale over 100 V. |
| DIRECT Mode | DC to 10 kHz. |
| **Filter:** | |
| Optional Filter<br>(Direct Mode or after RMS conversion) | 15 Hz low pass - provision for plug-in capacitors for user selected response. |
| Filter activation | ON/OFF selection by front panel button or remote terminal via software commands. |
| **Noise (referred to input):** | |
| 0.1 Hz to 100 Hz | less than 20 microvolts peak-to-peak. |
| 0.1 Hz to 10KHz | less than 50 microvolts peak-to-peak. |

Common Mode Rejection:

Inputs to common -

| | |
|---|---|
| DC coupled | 55 dB with 1 kohm unbalance, either input to circuit common; 60 Hz sine wave. |
| AC coupled | 45 dB with 1 kohm unbalance, either input to circuit common; 60 Hz sine wave. |
| Inputs to Output | 100 dB at 60 Hz with 1 kohm unbalance. |

## Power Requirements

Supply #1:

| | |
|---|---|
| Voltage | ±15VDC. @ ± 5% |
| Current | 100 mA (each supply) |
| Isolation | 350 VRMS IEC 348 rated. Isolated from chassis ground and other supplies. |

Supply #2:

| | |
|---|---|
| Voltage | +5VDC. @ ±5% |
| Current | 500 mA. |
| Isolation | None required. Common referenced to Chassis |

Supply #3

| | |
|---|---|
| Voltage | 13VRMS @ ±10% |
| Frequency | 45 to 440 Hz sine wave. |
| Current | 600 mA. |
| Isolation | 350 VRMS. IEC 348 rated. Isolated from chassis ground and other supplies. |

## Environment

Temperature:

| | |
|---|---|
| Within specification | 25 °C ±5 °C unless otherwise stated. |
| Operating | +0 °C. to +50 °C. |
| Storage | -40 °C to +70 °C (unpowered). |

Humidity, non-condensing:

| | |
|---|---|
| Within specifications | less than or equal to 50% at 25 °C, unless otherwise |
| Operating | 10% to 90% at 65 °F. |
| Storage | 90% maximum. |

### External Power

The [+] and [-]15 volts DC power supplies are made available on the input connector and referred to the input common. For external use: i.e., bridge excitation

| | |
|---|---|
| Voltage | ±15 VDC ±5% |
| Current | 25 milliamps maximum either supply. |

### Personality Module

A ROM which contains the "personality" of the signal conditioner. It contains all pertinent information - ranges, functions, features - of the conditioner in addition to instructions on how to access and control them.

### Signal Connector

Mounted on the rear of the Signal Conditioner. BANTAMATE (BURNDY). See Accessories in Maintenance, Section 4, and Figure 2-1 in Installation, Section 2.

### I/O Connector

48 pin DIN. Power, control and signal out.

### Physical Characteristics

| | |
|---|---|
| Dimensions | 6" high by 10" long by 2.2" wide. (15.24 cm high by 25.4 cm long by 5.6 cm wide.) See Fig. 2-1. |
| Weight | 4 lb.s (1.8Kg). |

# SIGNAL SOURCES

## GENERAL

An understanding of signal sources and connections in electrical measurement is vital to prevent noise or ambient conditions from over shadowing desired physical or electrical variables. Final data may be useless unless a signal source is properly selected or identified and used with an appropriate signal conditioner.

The following explanation of signal sources has been extracted from Gould Applications Booklet No. 101, *Signal Conditioning*.

## SIGNAL SOURCES

Selection of transducer or signal source(s) is the first step in most measurement or recording applications. Low impedance devices are preferred to reduce system noise and to minimize the shunting effect (loading) which the measuring instrument imposes on the source.

The signal source must be properly identified so that it can be matched with an appropriate signal conditioner. Signal sources fall into six class, according to the configuration of the output circuit. These are summarized below.

### Single Ended - Grounded

This signal source has two output terminals, one of which is connected to source ground as shown in illustration "A" of Figure B-1, Classification of Signal Sources. The AC line powered signal generator with a two terminal grounded output is typical.

### Single Ended - Floating

This source has two output terminals which are isolated from ground as shown in illustration "B". A *floating* output can be grounded or reversed without disturbing the circuit. The dry cell battery, the output from a magnetic head, or a two terminal battery powered signal generator are typical examples.

### Single Ended - Driven Off Ground

This source has two output terminals which are driven off ground by a second voltage, as shown in illustration "C". A *driven off ground* signal source can **NEVER** be grounded. A resistive shunt installed in the hot side of a power line or DC bus for measuring current is a classic example.

### Balanced - Grounded

This signal source has two active output terminals which have equal impedance to a common ground, as shown in illustration "D". The output terminals can be reversed without disturbing the circuit. A four-arm wheatstone bridge output that is excited from a grounded power supply is a good example.

### Balanced - Floating

This source is one that has two active output terminals which have equal impedance to common point that is floating, is shown in illustration "E". A four arm wheatstone bridge output that is excited from a *floating* power supply or a center-tapped transformer secondary are typical examples. The output terminals can be reversed or the common terminal can be grounded without disturbing the circuit.

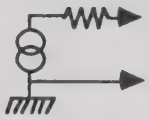
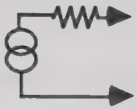
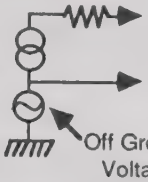
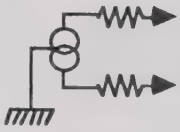
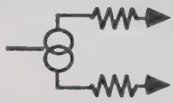
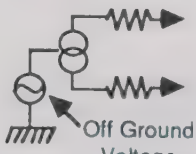
| Source | Description | Examples |
|---|---|---|
| Single ended - grounded<br>A  | Two ouput terminals, one of which is connected to ground. | AC line powered signal generator. |
| Single ended - floating<br>B  | Unbalanced output, isolated from ground. Can be grounded without disturbing circuit. | Dry cell battery. Magnetic head. Battery powered signal generator. |
| Single ended - driven off ground<br>C  | Unbalanced output driven off ground by second voltage source. Cannot be grounded. | Resistive shunt in hot side of line or buss -- for measuring current. |
| Balanced - grounded<br>D  | Terminals have equal impedance to common ground. | Four arm Wheatstone bridge excited from grounded DC supply. |
| Balanced - floating<br>E  | Terminals have equal impedance to floating common point. Common point can be grounded without disturbing circuit. | Four arm Wheatstone bridge excited from floating DC supply. Center-tapped transformer. |
| Balanced - driven off ground<br>F  | Terminals have equal impedance to common point driven off ground by a second voltage source. Cannot be grounded. | Differential ouput recorder amplifier (e.g., device with ±30 V ouput, operates in 0 - 60 V range.) |

FIGURE B-1
CLASSIFICATION OF SIGNAL SOURCES

### Balanced - Driven Off Ground

This source has two active output terminals which have equal impedance to a common point which is driven off ground by a second voltage, as shown in illustration "F". The active output terminals can be grounded without disturbing or destroying the signal source. An example is a differential output amplifier which produces an output of ±30 volts, but operates at about +60 volts DC off ground.

## IDENTIFICATION OF SIGNAL SOURCES

If an electrical schematic is not available, a signal source may be identified by using one channel of a Gould recorder plus an ohmmeter. To identify a two-terminal source, the ground or low recorder input terminal is connected to a good solid ground at the signal source. With the source turned ON, the high side of the recorder input is connected to one output terminal of the signal source and then the other. The amplitude and character of these two measurements provide the required information about the source.

A zero signal from one signal source terminal and a usable signal from the other indicate a single ended-grounded source. Equal 60 Hz noise signals from both terminals indicate a floating source, and if there are only two terminals a floating source is probably single ended floating. A resistance of several hundred megohms from each terminal to ground confirms that the source is floating. Usable but unequal signals from the two terminals indicate a driven off ground output. The average of the two signals is the off ground or common mode voltage; the difference is the signal amplitude. If the two-terminal source is turned OFF and the ohmmeter shows unequal resistance from the terminals to ground, the source is probably single ended-driven off ground. For all three source types, an ohmmeter across the two terminals with the source turned OFF indicates the source resistance.

To identify a three terminal source, the ground or low recorder input terminal is again grounded at the signal source. The high recorder terminal is connected to each of the three source output terminals in sequence.

A zero signal from one terminal and equal or similar signals from the other two indicates a balanced-grounded source. With the signal source turned OFF, resistance readings from ground to each terminal identify the ground terminal and the source resistance of each active output terminal to ground. Equal 60 Hz noise signals from the three terminals, and a resistance of several hundred megohms between all three terminals to ground, indicates a balanced-floating source. With the source turned OFF, ohmmeter readings across the three output terminals reveal the common terminal, the source resistance of each leg to common, and the total source resistance.

A usable signal from one terminal to ground and nearly equal signals from the other two, indicates a driven off ground source. The terminal with the minimum signal or a signal different from the other two is probably the common terminal, and the signal from it to ground is the off-ground or common mode voltage. With the source turned OFF, equal resistance readings taken across the three output terminals reveal the common terminal, the output resistance of each leg to common and the total source resistance.

### The Elusive Ground Loop

The GROUND LOOP is the largest source of electrical noise between electronics modules. More than one ground on a signal circuit or signal cable shield produces a common impedance coupling or ground loop between these two points. This generates large 60 Hz electrical noise currents which are in series and combined with the useful signal. The magnitude of ground loop current is directly proportional to the difference in absolute potential between the two grounds. In most cases a ground loop through either a cable shield or signal circuit will produce so much 60 Hz noise that it will obscure millivolt level signals.

Two separate grounds are seldom, if ever, at the same absolute voltage. This potential difference creates unwanted current in series with one of the signal leads. In illustration "A" of Figure B-2 the potential

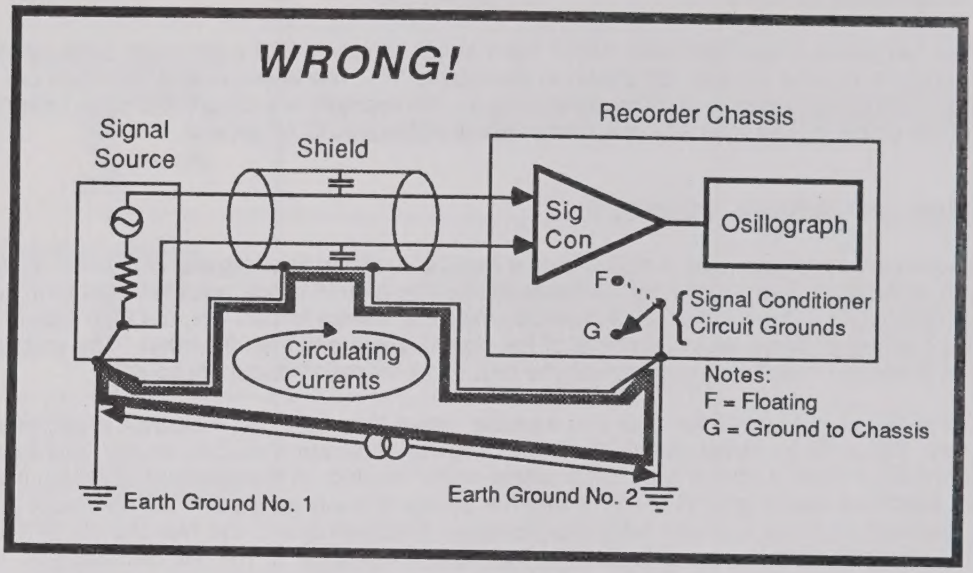
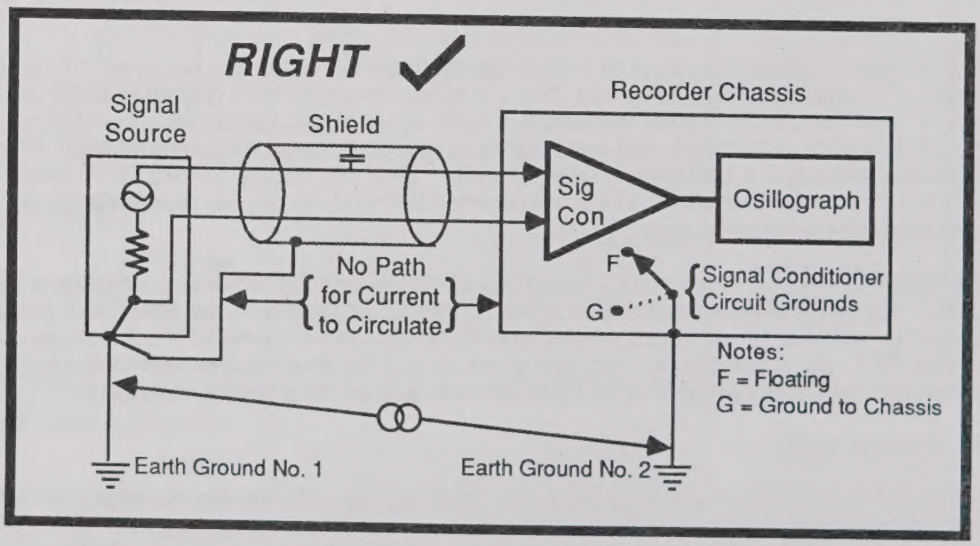



**ILLUSTRATION A**

Typical ground loop is created by more than one ground on a signal circuit.




**ILLLUSTRATION B**

Ground loops are eliminated by turning the signal conditioner input switch to the FLOATING position and removing jumper from Earth Ground No. 2 to signal cable shield.

**FIGURE B-2**
**ELIMINATING GROUND LOOPS**

difference between "Earth Ground No. 1" and "Earth Ground No. 2" produces ground loop current in the lower signal lead from the signal source to the input of the signal conditioner, causing ground loop noise to be combined with the useful signal. There is a second ground loop in illustration "A" through the signal cable shield from the signal source to the signal conditioner. The ground loop current in the shield is coupled to the signal pair through the distributed capacity in the signal cable. This current is returned through the output impedance of the signal source and back to Earth Ground No. 1, adding a second source of noise to the useful signal. Either one of these ground loops is capable of generating a noise signal that is at least one hundred times larger than a typical millivolt level signal.

The signal conditioner shown in illustration "B" of Figure B-2 is capable of being FLOATED a few volts off ground. The ground loop through the signal lead can be broken by simply lifting the signal conditioner grounding strap. The signal conditioner enclosure is still solidly grounded to "Earth Ground No. 2" but this will not create a ground loop since the signal conditioner enclosure is insulated from the signal circuit. The ground loop through the signal cable shield is eliminated by removing the jumper from the cable shield to "Earth Ground No. 2". Now the signal source and the signal cable shield are grounded ONLY at the signal source, which is the proper configuration for minimum noise pickup.

In off-ground measurements, the signal cable shield should NOT be grounded. Effective shielding is secure by stabilizing the signal cable shield with respect to the useful signal. The signal cable should be connected to either the center tap or the low side of the signal source. Since the signal cable shield is being driven by an off-ground common mode voltage, it is necessary that the cable have appropriate insulation between the shield and the outside of the cable. **THIS IS VERY IMPORTANT.**

### Guide Lines on Grounding

The following guide lines should be maintained when grounding signal sources. See Figure B-2.

- The recording system should have a stable system ground.
- The signal circuit should never be grounded at more than one point.
- The signal cable shield should not be attached to more than one ground, and this ground should be at the signal source.
- More than one intentional or accidental ground on the signal circuit or signal cable shield will produce excessive electrical noise in any low level circuit.
- In off-ground recording, the signal cable shield should *not* be grounded; it should be connected to the center tap or the low side of the signal source.